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Patient-Reported Complications and Functional Outcomes of Male-to-Female Sex Reassignment Surgery

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Abstract This study examined preoperative preparations, complications, and physical and functional outcomes of male-to-female sex reassignment surgery (SRS), based on reports by 232 patients, all of whom underwent penile-inversion vaginoplasty and sensate clitoroplasty, performed by one surgeon using a consistent technique. Nearly all patients discontinued hormone therapy before SRS and most reported that doing so created no difficulties. Preoperative electrolysis to remove genital hair, undergone by most patients, was not associated with less serious vaginal hair problems. No patients reported rectal-vaginal fistula or deep-vein thrombosis and reports of other significant surgical complications were uncommon. One third of patients, however, reported urinary stream problems. No single complication was significantly associated with regretting SRS. Satisfaction with most physical and functional outcomes of SRS was high; participants were least satisfied with vaginal lubrication, vaginal touch sensation, and vaginal erotic sensation. Frequency of achieving orgasm after SRS was not significantly associated with most general measures of satisfaction. Later years of surgery, reflecting greater surgeon experience, were not associated with lower prevalence rates for most complications or with better ratings for most physical and functional outcomes of SRS.

Keywords Transsexual · Sex reassignment surgery · Vaginoplasty · Follow-up · Complications

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Introduction

Sex reassignment surgery (SRS) is intended to treat a condition, gender identity disorder or transsexualism, that can only be diagnosed on the basis of patients' self-reports (Cohen-Kettenis & Gooren, 1999). For this reason, patients' reports of satisfaction or regret are now recognized as one of the most meaningful bases for judging the success of SRS (Green & Fleming, 1990; Kuiper & Cohen-Kettenis, 1988). Numerous studies of male-to-female (MtF) transsexuals who have undergone SRS (i.e., vaginoplasty) have attempted to determine whether specific patient characteristics (e.g., age, transsexual typology, coexisting mental health problems) or nonsurgical treatment variables (e.g., amount and adequacy of presurgical psychotherapy, duration of real-life experience in the desired gender role) are associated with greater patient satisfaction following SRS (for reviews, see Green & Fleming, 1990; Lawrence, 2003; Smith, van Goozen, Kuiper, & Cohen-Kettenis, 2005).

Considerably fewer studies have attempted to determine whether specific surgical treatment variables or surgical outcomes are associated with greater patient satisfaction following MtF SRS. Several reports have described the surgical complications of MtF SRS. Table 1 displays the frequency of such complications reported in selected English-language surgical follow-up studies, published over the last 20 years. While information about the nature and prevalence of surgical complications provides some useful guidance to patients and caregivers, the surveillance periods for surgical follow-up are often brief, patients are not uncommonly lost to follow-up, and the relationship between surgical complications and patient satisfaction has rarely been specifically addressed. While it seems reasonable to assume that surgical complications might be associated with reduced patient satisfaction, there is surprisingly little empirical support for

Table 1 Frequency of complications after MtF SRS in selected studies

Study	*N*	Number of complications reported					
		Rectal-vaginal fistula	Vaginal stenosis	Urethral stenosis	Clitoral necrosis[a]	Vaginal prolapse	Other major complications
McEwen, Ceber, & Daws (1986)	68	1	5	1		2	rectal perforation (4)
Small (1987)	11	0	1	2	—		
Bouman (1988)	55	—	4	6	—		
Stein, Tiefer, & Melman (1990)	14	0	4	1	—	—	
Fang, Chen, & Ma (1992)	9	1	—	—	0	—	
Eldh (1993)	20	1	—	3	1	—	vaginal hair ("some")
Perovic (1993)	25	0	2	—	—	2	
Rubin (1993)	13	2	4	1	6	—	vesical-vaginal fistula (1)
van Noort & Nicolai (1993)	27	3	5	4		7	vaginal hair (2)
Huang (1995)[b]	109	0	4	7	—		vaginal hair (1)
Hage & Karim (1996)	60	—	—	—	0	—	
Eldh, Berg, & Gustafsson (1997)[c]	46	1	4	—	—	4	
Rehman & Melman (1999)	10	—	—	—	2	—	
Perovic, Stanojevic, & Djordjevic (2000)	89	1	6	1	—	0	
Krege, Bex, Lümmen, & Rübben (2001)	66	3	—	7	3	2	necrosis of urethra (1)

Note. All studies used a penile-inversion vaginoplasty technique, with or without scrotal skin flaps or grafts. A dash indicates that the presence or absence of a complication was not reported.

[a]Necrosis of sensate neoclitoris constructed from the glans penis; a blank cell indicates that this clitoroplasty technique was not used.

[b]Patients who underwent SRS from 1978 to 1992 only.

[c]Patients who underwent SRS from 1986 to 1995 only.

this proposition. Pfäfflin and Junge (1992/1998), in their comprehensive review of SRS outcome studies published between 1961 and 1991, could find no consistent evidence that the quality of surgical results affected patient satisfaction. They noted that it was not unusual for patients to be satisfied despite objectively unsatisfactory surgical results or to be dissatisfied despite objectively satisfactory results. A small study by Ross and Need (1989) is sometimes cited in support of the proposition that surgical complications are associated with less satisfactory outcomes of SRS, but this study examined the relationship between complications and clinicians' ratings of patients' mental health, not patients' self-reported satisfaction; moreover, most of the variance in mental health ratings was attributable to complications of breast augmentation, not complications of vaginoplasty.

In addition to describing surgical complications, some surgical follow-up studies have described other physical or functional outcomes of MtF SRS, including neovaginal dimensions, the adequacy of the neovagina for coitus, genital appearance, and patients' ability to achieve orgasm after SRS. Although these factors may plausibly be related to patient satisfaction, only a few studies have formally investigated such associations. Schroder and Carroll (1999), in a study of 17 MtF patients, reported that neovaginal dimensions and vulvar appearance were positively correlated with patients' ratings of the overall success of SRS. Muirhead-Allwood, Royle, and Young (1999a, 1999b) examined 140 patients' subjective ratings on 17 variables representing specific physical and functional outcomes of MtF SRS. Principal component analysis revealed three interpretable factors—erotic sensation, absence of physical problems, and satisfaction with physical dimensions—but only the first two of these were correlated with the highest level of self-reported improvement in quality of life after SRS.

The influence of preoperative regimens on surgical outcomes and patient satisfaction has also received little attention. Many surgeons require patients to discontinue the use of feminizing hormones several weeks before surgery, in an attempt to prevent perioperative deep-vein thrombosis (DVT) and pulmonary embolism (e.g., Eldh, 1993; Hage, 1999; Rehman & Melman, 1999; see also Futterweit, 1998), while other surgeons question the value of this requirement (e.g., Edgerton, 1993) or suggest that it results in unnecessary patient discomfort (e.g., Bowers, 2004a). However, neither the proposed benefits nor the subjective effects of preoperative discontinuation of feminizing hormones have been formally investigated. Some surgeons advise patients to undergo preoperative electrolysis to remove hair from penile and scrotal skin that will be used to line the neovagina, in the belief that this treatment may reduce the likelihood of symptomatic intravaginal hair postoperatively (e.g., Bowers, 2004b). However, the proposed benefit of genital electrolysis in preparation for MtF SRS has not been formally investigated.

The influence of surgeon experience on postoperative complication rates and patient satisfaction following MtF SRS is also incompletely understood, although there is evidence that the prevalence of some surgical complications declines as experience increases (e.g., Eldh, Berg, & Gustafsson, 1997; Huang, 1995). It is also unclear whether performance of *labiaplasty*, an optional secondary surgical operation that brings the upper ends of the labia together in the midline above the clitoris and better defines the labia minora (see Hage, Goedkoop, Karim, & Kanhai, 2000), contributes to patient satisfaction after SRS.

A follow-up survey of patients who underwent MtF SRS with surgeon Toby Meltzer in Portland, Oregon, between May 1994 and March 2000 (see Lawrence, 2003, 2005) provided an opportunity to examine these questions, based on patients' self-reports.

Method

Participants

Survey participants have been described in detail in previous reports (Lawrence, 2003, 2005). Their mean age at time of SRS was 44 years ($SD = 9$ years; range, 18–70) and they were surveyed a mean of 3 years ($SD = 1$ year; range, 1–7) after SRS.

Preoperative preparation and surgical technique

Patients were instructed to discontinue using feminizing hormones 3 weeks before SRS. Starting in 1997, patients were advised to undergo removal of hair from the penis and scrotum by electrolysis prior to SRS. Meltzer's SRS technique involved creation of a neovagina lined with inverted penile and scrotal skin and construction of a sensate neoclitoris from the glans penis, using a technique similar to that of Fang, Chen, and Ma (1992). No earlier than 3 months after SRS, some patients underwent an optional labiaplasty, using a technique similar to that described by Laub (1997). Some patients also underwent other secondary surgical procedures to improve genital appearance or function, including revision of the urethral meatus (see Karim, Hage, Bouman, & Dekker, 1991) or surgery to widen or deepen the vagina.

Survey method and measures

The survey procedures, including the method by which informed consent was obtained, have been described previously (Lawrence, 2003) and will be summarized only briefly. Postoperative patients were surveyed using a mailed questionnaire, which they completed and returned anonymously. Of 727 eligible patients, 310 (43%) could not be contacted, either due to lack of a current mailing address ($n = 307$) or death ($n = 3$); 185 (25%) were contacted but either declined to participate ($n = 62$), failed to return a questionnaire ($n = 120$), or returned a questionnaire with an ineligible year of surgery ($n = 3$); and 232 (32%) patients, the participant group, returned valid questionnaires.

Many questionnaire items were adapted from a questionnaire developed by Muirhead-Allwood (1998) and others were written by the author. Most questionnaire items relevant to this report have been described previously (Lawrence, 2003, 2005) and will be summarized only briefly.

Participants reported the year in which they had undergone SRS and whether they had undergone any of four additional surgical procedures (*yes* or *no*), all of which were described in lay terms: (a) labiaplasty, (b) revision of the urethral meatus, (c) surgery to widen or deepen the vagina, or (d) other secondary genital surgery, which participants were asked to specify. Participants reported whether they had stopped taking feminizing hormones before surgery (*yes* or *no*) and, if so, how long before surgery they had done so (in days or weeks). Participants who had stopped taking hormones reported whether this had been difficult for them (*yes* or *no*) and what symptoms, if any, they had experienced in connection with stopping. Participants also reported whether they had undergone any electrolysis of their scrotum or other genital areas in preparation for SRS (*yes* or *no*) and, if so, how many hours of electrolysis they had undergone.

Participants reported whether they had experienced any of 10 physical complications of SRS (*yes* or *no*), all of which were described in lay terms (see Lawrence, 2003): rectal-vaginal fistula, vaginal prolapse, vaginal stenosis at all times, vaginal stenosis during sexual arousal only, misdirected urinary stream, urethral stenosis, clitoral necrosis, genital pain, DVT, and "other (specify)." They also reported their experience concerning 19 physical and functional outcomes of SRS, all rated on 11-point Likert scales from 0 (*very poor*, *major problem*, etc.) to 10 (*excellent*, *no problem*, etc.) and all described in lay terms (see Lawrence, 2003). These outcomes included: vaginal depth, vaginal width, vaginal lubrication, vaginal discharge, vaginal hair growth, sensation to touch at the vaginal opening, sensation to touch deep in the vagina, vaginal pain with penetration, vaginal itching, vaginal prolapse, vaginal erotic sensation, clitoral touch sensation, clitoral erotic sensation, clitoral pain, clitoral itching, discharge from around the clitoris, hair on or around the clitoris, urine leakage with cough or strain, and postoperative bladder infections. Participants reported their ability to achieve orgasm with masturbation after SRS on a 5-point scale from *never* to *almost always*, with the additional option of *don't know or not applicable*.

Finally, participants completed four measures of their overall satisfaction with SRS. They reported whether they regretted having undergone SRS (*yes*, *sometimes*, or *no*); their overall happiness with sexual functioning after SRS result and their overall happiness with their SRS result, both on an 11-point Likert scale from 0 (*very unhappy*) to 10 (*very happy*); and how much they felt their quality of life had worsened or improved as a result of SRS, on a 21-point Likert scale from -10 (*most worsening possible*) to 10 (*most improvement possible*).

Hypotheses

Although the principal aims of the study were descriptive, several hypotheses of potential clinical relevance were formulated and examined:

1. Participants who had undergone preoperative electrolysis to remove genital hair would report less severe intravaginal hair problems than those who had undergone no electrolysis; moreover, a greater number of hours of genital electrolysis would be associated with better ratings concerning intravaginal hair problems.
2. Participants who had undergone labiaplasty would report higher ratings of overall satisfaction than those who had not.
3. Surgical complications would be associated with lower ratings of overall satisfaction.
4. Higher ratings of specific physical and functional outcomes of SRS would be associated with higher ratings of overall satisfaction.
5. More frequent ability to achieve orgasm after SRS would be associated with higher ratings of overall satisfaction.
6. Later years of surgery, reflecting greater surgeon experience, would be associated with higher ratings of overall satisfaction, fewer reported complications, higher ratings for specific physical and functional outcomes of SRS, and more frequent ability to achieve orgasm after SRS.

An alpha level of .05 was used for all statistical tests. Because the intent of the study was primarily exploratory, alpha levels were not adjusted for multiple comparisons.

Results

Overall satisfaction

No participants consistently regretted having undergone SRS and only 15 (6%) participants reported that they were sometimes regretful. Participants' mean rating for overall happiness with their genital sexual function after SRS was 7.8 ($SD = 2.4$; range, 0–10) and their mean rating for overall happiness with their SRS result was 8.7 ($SD = 1.6$; range, 0–10). Participants' mean rating of improvement in their quality of life with SRS was 7.9 ($SD = 2.6$; range, −2–10). Year of surgery, treated as a continuous variable, was not significantly associated with sometimes regretting SRS, based on logistic regression, $\chi^2(1, N = 229) = .03$, *ns*. Year of surgery was significantly associated with overall happiness with SRS result, $r(230) = .14$, $p = .03$,[1] but not with overall happiness with genital sexual function, $r(224) = .08$, *ns*, or with improvement in quality of life with SRS, $r(225) = .11$, $p = .09$.

Effects of discontinuing feminizing hormones

A total of 214 (92%) participants stopped taking feminizing hormones before SRS and 18 (8%) participants did not. Mean duration of abstinence among those who discontinued hormones was 22 days ($SD = 9$ days; range, 3–60). Among participants who discontinued hormones, 74 (35%) reported that this had been difficult. The most common symptoms reported by participants who stopped taking hormones were hot flashes (43 participants, 20% of those who stopped), mood swings or irritability (42 participants, 20% of those who stopped), and increases in facial or body hair growth (12 participants, 6% of those who stopped). No participants, including those who continued to use hormones, reported perioperative DVT.

Preoperative genital electrolysis and postoperative vaginal hair problems

A total of 172 (74%) participants reported that they had undergone preoperative electrolysis for genital hair removal. Among those who had undergone genital electrolysis, the mean number of hours reported was 21 ($SD = 30$; range, 0.4–300). There was no significant difference in mean rating for vaginal hair problems between participants who had or had not undergone genital electrolysis, 8.1 versus 7.8, $t(229) < 1$, *ns*. There was also no significant correlation between participants' ratings of vaginal hair problems and the number of hours of genital electrolysis they reported, $r(213) = .00$. Some participants reported many more hours of genital electrolysis than expected, raising the possibility that they had misinterpreted the question. Consequently, correlations between ratings of vaginal hair problems and number of hours of genital electrolysis were recomputed after excluding participants who reported more than 20, 30, 40, or 50 hours of electrolysis; in no cases were significant correlations found. Among the 17 participants reporting the most serious vaginal hair problems (those giving Likert scale ratings

[1] Based on Spearman rank-order correlation (i.e., with year of surgery treated as an ordinal variable), Lawrence (2003) reported that year of surgery was not significantly associated with happiness with SRS result, $r_s(230) = .09$, $p = .15$.

of 0, 1, or 2), 10 participants had undergone some genital electrolysis, with a mean duration of 34 h ($SD = 33$ h; range, 2–100). Year of surgery in the 17 participants reporting the most serious vaginal hair problems ranged from 1994 to 2000.

Additional genital surgical procedures undergone

Most participants had undergone at least one additional genital surgical procedure following vaginoplasty. Sixty-two (27%) participants had undergone both labiaplasty and a revision of the urethral meatus, 117 (50%) participants had undergone labiaplasty but not revision of the urethral meatus, 4 (2%) participants had undergone revision of the urethral meatus but not labiaplasty, and 49 (21%) participants had undergone neither procedure. Five (2%) participants had undergone an additional procedure to deepen or widen the neovagina. Eleven (5%) participants had undergone some other additional genital surgical procedure, including three instances of removal of excess periurethral erectile tissue; two instances each of revision of the clitoris, the labia, and the vaginal introitus; one instance of liposuction of the mons area; and one unspecified procedure.

There were no significant associations between having undergone any additional genital surgical procedure and sometimes regretting SRS, based on Fisher's exact tests. Participants who had undergone labiaplasty displayed a nonsignificant trend toward reporting greater improvement in quality of life with SRS than those who had not, 8.1 versus 7.4, $t(225) = 1.75$, $p = .08$. However, having undergone labiaplasty was not significantly associated with greater overall happiness with genital sexual function or greater overall happiness with SRS result. There were no significant associations between having undergone any other additional surgical procedure and greater overall happiness with genital sexual function, overall happiness with SRS result, or overall improvement in quality of life with SRS.

Postoperative complications

No participants reported having experienced rectal-vaginal fistula or DVT. No participants reported having experienced

Table 2 Complications of SRS and overall measures of satisfaction

Complication	*n*	%	Regret SRS sometimes		Happiness with sexual function		Happiness with SRS result		Improvement in QOL[a]	
			n	%[b]	*M*	*SD*	*M*	*SD*	*M*	*SD*
Vaginal stenosis at all times										
Present	19	8	3	16	5.9***	3.2	6.8****	3.1	7.2	2.9
Absent	212	92	12	6	8.0	2.2	8.9	1.3	8.0	2.6
Vaginal stenosis during arousal										
Presnt	15	6	1	7	8.3	1.5	8.1	2.2	8.3	2.7
Absent	216	94	14	6	7.8	2.4	8.8	1.6	7.9	2.6
Misdirected urinary stream										
Present	77	33	6	8	7.7	2.2	8.7	1.5	8.0	2.5
Absent	154	67	9	6	7.9	2.4	8.8	1.7	7.9	2.7
Urethral stenosis										
Present	9	4	1	11	7.7	2.2	8.2	1.3	8.9	1.4
Absent	222	96	14	6	7.8	2.3	8.8	1.7	7.9	1.7
Clitoral necrosis										
Present	8	3	2	25	5.0***	3.5	6.8***	1.9	8.0	2.3
Absent	223	97	13	6	7.9	2.2	8.8	1.6	8.0	2.6
Pain in vagina or genitals										
Present	20	9	3	15	6.0***	3.2	7.1****	2.9	6.6*	3.0
Absent	211	91	12	6	8.0	2.2	8.9	1.4	8.0	2.5
Other complications[c]										
Present	27	12	3	11	6.5**	3.3	7.9**	2.7	7.7	2.6
Absent	204	88	12	6	8.0	2.1	8.8	1.4	7.9	2.6

Note. Happiness with sexual function and with SRS result represent 0–10 Likert scale ratings. Improvement in QOL represents −10 to +10 Likert scale ratings. Higher numbers indicate better outcomes. No *p* values for Regret are significant by Fisher' exact test, $N = 231$. *p* values for other measures of satisfaction are by *t*-test, Ns = 225–232. All *p* values are two-tailed.

*$p < .05$, **$p < .01$, ***$p < .001$, ****$p < .0001$, all versus the complication-absent condition.

[a] Quality of life.

[b] Of those reporting a complication or its absence.

[c] Includes infections, bleeding, poor healing, other tissue loss or necrosis, urinary incontinence, and numbness.

vaginal prolapse as a complication, but 4 participants reported problematic vaginal prolapse in the section of the questionnaire addressing physical and functional outcomes; the reason for this discrepancy is unclear. The frequency of other surgical complications is summarized in Table 2. Most complications were uncommon and 109 (47%) participants reported no complications of any kind.

Associations between the presence or absence of complications and overall measures of satisfaction after SRS are also summarized in Table 2. There were no significant associations between any complication and sometimes regretting SRS. Vaginal stenosis at all times, clitoral necrosis, genital pain, and "other" complications were significantly associated with lower ratings of happiness with overall genital sexual function and overall happiness with SRS result. Genital pain was significantly associated with lower ratings of improvement in quality of life with SRS. Vaginal stenosis with sexual arousal only, misdirected urinary stream, and urethral stenosis showed no significant associations with any overall measure of satisfaction.

Associations between reported complications and year of surgery, treated as a continuous variable, were examined using logistic regression analysis. Only one association was statistically significant: Vaginal stenosis during sexual arousal only was more likely to have been associated with an earlier year of surgery, $\chi^2(1, N = 230) = 9.8, p = .002$.

Satisfaction with specific physical and functional outcomes

Participants' ratings of satisfaction with specific physical and functional outcomes of SRS are summarized in Table 3. Participants' satisfaction was generally high for all measures except vaginal lubrication, touch sensation deep in the vagina, and erotic sensation in the vagina.

Associations between satisfaction with specific physical and functional outcomes of SRS and overall measures of satisfaction are also summarized in Table 3. All measures of satisfaction with genital touch sensation and genital erotic sensation were significantly correlated with overall happiness with sexual function, overall happiness with SRS result, and improvement in quality of life with SRS. Satisfaction with erotic sensation in the clitoris and vagina and with touch sensation at the vaginal introitus were also significantly associated with absence of regret.

Specific outcome measures addressing vaginal dimensions (satisfaction with vaginal depth, satisfaction with

Table 3 Physical and functional outcomes of SRS and overall measures of satisfaction

			Associations with measures of satisfaction			
Physical or functional outcome	*M*	*SD*	Absence of regret, χ^2	Happiness with sexual function, *r*	Happiness with SRS result, *r*	Improvement in QOL[a], *r*
Vaginal depth	7.5	2.1	2.6	.37****	.45****	.18**
Vaginal width	7.4	2.3	9.0**	.38****	.51****	.20**
Vaginal lubrication	4.4	2.8	7.8**	.30****	.37****	.25***
Vaginal discharge	9.2	2.0	1.8	.00	.02	.03
Vaginal hair	8.0	2.9	9.1**	.14*	.13	.14*
Touch sensation at vaginal introitus	7.8	2.3	4.1*	.47****	.31****	.25***
Touch sensation deep in vagina	6.6	2.9	1.0	.42****	.26****	.19**
Pain with vaginal penetration	7.1	2.4	3.1	.39****	.42****	.22***
Vaginal itching	9.1	1.9	0.3	.08	.16*	.04
Vaginal prolapse	9.8	1.3	2.2	.07	.09	.00
Erotic sensation in vagina	6.5	3.2	9.2**	.61****	.36****	.18**
Touch sensation in clitoris	8.6	2.1	2.5	.56****	.35****	.13*
Erotic sensation in clitoris	7.8	2.7	21.2****	.63****	.38****	.15*
Pain in or around clitoris	9.3	1.9	8.7**	.26****	.27****	.11
Itching in or around clitoris	9.4	1.6	2.3	.04	.07	.10
Discharge from around clitoris	9.6	1.5	0.5	.02	.05	.03
Hair on or around clitoris	8.3	2.8	3.5	.11	.12	.15*
Urine leakage with strain or cough	9.1	2.1	3.1	.33****	.29****	.07
Bladder infections	8.5	2.5	0.1	.25***	.17**	− .07

Note. Physical and functional outcomes represent 0–10 Likert scale ratings; higher numbers represent better outcomes. Associations with absence of regret are by logistic regression, $df = 1$, $Ns = 228–231$. Associations with other measures of satisfaction are by Pearson correlation, $Ns = 222–232$. All *p* values are two-tailed.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{****}p < .0001$.

[a]Quality of life.

vaginal width, and absence of vaginal pain with penetration) were significantly correlated with overall happiness with genital sexual function, overall happiness with SRS result, and improvement in quality of life with SRS. Satisfaction with vaginal width was associated with absence of regret. Satisfaction with vaginal lubrication, which may be conceptually related to both genital sensation and vaginal dimension issues, was significantly associated with all four overall outcome measures.

Among other potentially problematic physical and functional outcomes of SRS, vaginal hair and clitoral pain were especially notable: For both items, lower satisfaction ratings were significantly associated with regretting SRS sometimes and with lower ratings on two other overall outcome measures. Lower satisfaction ratings on two urinary problems, urine leakage with cough or strain and bladder infections, were associated with lower ratings on overall happiness with genital sexual function and overall happiness with SRS result. For the remaining six physical and functional outcome categories, nearly all associations were nonsignificant.

Only two associations between specific physical and functional outcomes of SRS and year of surgery were statistically significant: Later years of surgery were significantly associated with higher ratings of happiness with vaginal depth, $r(230) = .26$, $p = .0001$, and vaginal width, $r(230) = .14$, $p = .03$.

Frequency of achieving orgasm after SRS

Frequency of achieving orgasm with masturbation after SRS and its relationship to overall measures of satisfaction are summarized in Table 4. Frequency of achieving orgasm was not significantly associated with sometimes regretting SRS, based on a Fisher-Freeman-Halton test, $p = .064$. Frequency of achieving orgasm was significantly associated with overall happiness with sexual function, $F(5, 220) = 17.0$, $p < .0001$, but not with overall happiness with SRS result, $F(5, 227) = 1.9$, $p = .097$, or improvement in quality of life with SRS, $F(5, 222) = .83$, *ns*. Post-hoc analyses using Tukey-Kramer HSD tests demonstrated that individuals who were "never" able to achieve orgasm were significantly less happy with their sexual function than persons in other categories and that persons who were "rarely" able to achieve orgasm were significantly less happy than those who were able to achieve orgasm "almost always."

With "don't know/not applicable" responses omitted, frequency of achieving orgasm, treated as an ordinal variable, was significantly correlated with overall happiness with sexual function, $r_s(213) = .45$, $p < .0001$, but not with overall happiness with SRS result, $r_s(217) = .13$, $p = .06$, or with improvement in quality of life with SRS, $r_s(212) = .04$, $p = .52$. Frequency of achieving orgasm was significantly but negatively correlated with year of surgery, $r_s(215) = -.15$, $p = .03$.

Discussion

The goals of this study were: (a) to describe the complications and physical and functional outcomes of MtF SRS reported by a large group of patients who had undergone SRS using a consistent surgical technique and (b) to examine how these outcomes, along with preoperative preparations, additional genital surgery undergone, and surgeon experience, were related to patient satisfaction. The study's descriptive data concerning surgical outcomes represent the experiences of the largest group ($N = 232$) of MtF patients of one surgeon published to date. Moreover, these data represent outcomes of a surgical technique that has become the de facto international standard, combining penile inversion vaginoplasty, widely regarded as the preferred technique for MtF SRS (Giraldo, Mora, Solano, Gonzáles, & Smith-Fernández, 2002; Hage, 1999; Karim, Hage, & Mulder, 1996), with glans-derived sensate clitoroplasty, described as the "state of the art in neoclitoroplasty" (Hage & Karim, 1996, p. 624) and "the best choice for neoclitoroplasty, and the 'gold standard' against which other procedures are compared" (Giraldo et al., 2002, p. 1308). Consequently, the study's descriptive data may be of interest to clinicians and MtF transsexual patients who want to calibrate their expectations concerning the outcomes of contemporary MtF SRS technique.

Nearly all participants complied with instructions to stop taking hormones before SRS and most reported that stopping was not difficult. The most common side-effects after stopping hormones were hot flashes and mood changes. Clinicians may wish to inform their MtF SRS patients about these common side-effects.

Vaginal hair was a significant complaint for a small percentage of participants. It was hypothesized that participants who had undergone preoperative electrolysis of genital hair would report less severe intravaginal hair problems and that more hours of electrolysis would be associated with better self-reported outcomes for intravaginal hair, but no significant effects were found. These results suggest that, when hair-bearing genital skin is used to line the neovagina in MtF SRS, preoperative genital electrolysis does not demonstrably reduce complaints of postoperative vaginal hair problems. In natal women with vaginal agenesis who undergo vaginoplasty using full-thickness grafts or flaps of hair-bearing skin, vaginal hair follicles sometimes eventually disappear or at least cannot be detected on biopsy (Pierce, Klabunde, O'Connor, & Long, 1956; Whitacre & Alden, 1951). This has been reported to occur as early as a few months after surgery (Whitacre & Alden, 1951). Some surgeons (e.g., Eldh, 1993; Huang, 1995; Small, 1987; van Noort &

Nicolai, 1993) have proposed that a similar process occurs when hair-bearing skin is used intravaginally in MtF SRS, implying that vaginal hair eventually becomes a minimal or nonexistent problem. However, this opinion is not universal (Edgerton, 1993, 1995; Hage, 1995). A few participants in this study reported significant vaginal hair problems as long as six years after vaginoplasty, suggesting that passage of time does not reliably eliminate these complaints.

Most participants had undergone labiaplasty following their initial SRS operation and over one quarter had undergone a revision of the urethral meatus. It was hypothesized that participants who had undergone labiaplasty would report greater overall satisfaction than those who had not, but no significant association was found.

Reports of significant surgical complications were uncommon and there were no reports of recto-vaginal fistula or DVT, two of the most serious complications. A misdirected urinary stream, usually considered to be a minor complication, was reported by 33% of participants, higher than in the small study published by Blanchard, Legault, and Lindsay (1987). Vaginal stenosis with sexual arousal, reported by 6% of participants, may have been related to incompletely resected periurethral erectile tissue, as described by Karim, Hage, Bouman, and Dekker (1991). Later years of surgery, reflecting greater surgeon experience, were associated with significantly fewer instances of this complication but not with significantly fewer instances of other complications. It is especially notable that misdirected urinary stream, the complication most commonly reported, did not become significantly less frequent in later years. These observations suggest that, while greater surgeon experience may be associated with more satisfactory removal of periurethral erectile tissue and less likelihood of vaginal stenosis during sexual arousal, urinary stream problems may continue to occur frequently.

It was hypothesized that participants who experienced complications would report lower overall satisfaction than those who did not, but significant differences were found only for vaginal stenosis at all times, clitoral necrosis, genital pain, and "other" complications. It is notable that no individual complications were significantly associated with regretting SRS, although a previous report (Lawrence, 2003) found that the presence of multiple complications was significantly associated with an increased likelihood of regret. Genital pain was reported by 9% of participants and was the only complication that was significantly associated with less improvement in quality of life with SRS. Although some reports of genital pain complications may have reflected pain with vaginal penetration, several participants who reported genital pain reported little problem with pain during vaginal penetration, based on favorable Likert scale ratings.

It may seem surprising that most reported surgical complications were not associated with lower overall satisfaction or with less improvement in quality of life with SRS. These findings are, however, consistent with the observation by Pfäfflin and Junge (1992/1998) that patients who undergo SRS often report being satisfied despite surgical outcomes that are objectively unsatisfactory. Possibly some participants in the current study reported complications that they did not regard as especially serious or consequential. In a study by Schroder (1995), 17 MtF transsexuals who had undergone SRS reported a total of 15 postsurgical complications, including 7 instances of vaginal stenosis, but only 3 individuals rated their complications as "serious." Moreover, MtF transsexuals who experience surgical complications may nevertheless feel that the benefits of SRS significantly outweigh any negative consequences of these complications. Schroder and Carroll (1999) noted that their MtF transsexual informants rated "absence of the genitals you wanted to be rid of" (p. 139) as the most important physical outcome of SRS. This result is invariably achieved in MtF SRS, even when surgical complications occur.

On average, participants expressed high levels of satisfaction with nearly all of the specific physical and functional outcomes of SRS. The outcomes with which they were least satisfied were vaginal erotic sensation, touch sensation deep in the vagina, and vaginal lubrication. Some participants may have had unrealistic expectations concerning vaginal

Table 4 Frequency of achieving orgasm after SRS and overall measures of satisfaction

Frequency of achieving orgasm with masturbation			Regret SRS sometimes		Happiness with sexual function		Happiness with SRS result		Improvement in QOL[a]	
	n	%	*n*	%[b]	*M*	*SD*	*M*	*SD*	*M*	*SD*
Almost always	82	36	2	2	8.8	1.5	9.0	1.4	8.0	2.4
More than half the time	27	12	1	4	8.2	1.4	8.9	1.0	8.4	1.7
Less than half the time	33	15	1	3	8.2	1.8	8.7	1.6	8.4	2.0
Rarely	34	15	5	15	7.4	2.3	8.7	1.4	7.4	3.2
Never	40	18	5	13	5.2	3.1	8.1	2.5	7.7	2.9
Don't know/not applicable	10	4	1	10	8.4	1.8	9.2	1.3	8.0	2.9
p for group differences			.064		<.0001		.097		*ns*	

Note. The *p* value for Regret is by Fisher-Freeman-Halton test; *p* values for other measures of satisfaction are by ANOVA, *N*s = 220–227.

[a]Quality of life.

[b]Of those giving this answer.

sensation. Kinsey, Pomeroy, Martin, and Gebhard (1953) observed that most natal women reported very little touch sensation or erotic sensation deep in the vagina. MtF transsexuals are sometimes surprised to learn that their vaginas are capable of lubrication. Vaginal lubrication is caused by transudation of fluid into the vaginal lumen due to pelvic vascular engorgement, a process that occurs in both natal (Levin, 1991, 2002) and surgically created vaginas (Masters & Johnson, 1961). Many natal women with vaginal agenesis who undergo skin graft vaginoplasties report achieving lubrication adequate for coitus (Allesandrescu, Peltecu, Buhimschi, & Buhimschi, 1996) and Muirhead-Allwood et al. (1999a) reported that a significant minority of their MtF SRS patients also experienced satisfactory vaginal lubrication. Physiologically, many or most MtF transsexual patients should be able to experience vaginal lubrication following vaginoplasty, if they are able to achieve high levels of sexual arousal and pelvic vasocongestion. Dissatisfaction with vaginal lubrication after MtF SRS may in part reflect difficulty in achieving high levels of sexual arousal.

It was hypothesized that higher ratings of specific physical and functional outcomes of SRS would be associated with higher overall satisfaction and significant associations were observed for most outcomes, especially those related to genital sensation and vaginal dimensions. Problems with clitoral pain, vaginal hair, stress incontinence, and bladder infections were also associated with lower overall satisfaction. These results confirm the observation by Muirhead-Allwood et al. (1999a, 1999b) that satisfaction with genital sensation is significantly associated with improvement in quality of life with SRS. However, in contrast to their findings, this study found that satisfaction with vaginal dimensions was also significantly associated with improvement in quality of life. These differing results may partly reflect different methodologies: Muirhead-Allwood et al. (1999a, 1999b) performed principle component analysis and used a dichotomous measure of improvement in quality of life with SRS, whereas this study examined specific outcomes individually and used a continuous measure of improvement in quality of life. The differing results may also partly reflect differing surgical technique: 14% of participants in the survey by Muirhead-Allwood et al. (1999a, 1999b) had undergone only "cosmetic surgery," without vaginoplasty. MtF transsexuals often express concern about achieving adequate vaginal depth following SRS and less frequently express concern about vaginal width; in this study, however, vaginal width was significantly associated with absence of regret, while vaginal depth was not. This is consistent with the observation by Perovic (1993) that even patients with vaginas as short as 9 cm were satisfied after SRS, if their vaginas were wide enough.

It was hypothesized that more frequent ability to achieve orgasm after SRS would be associated with higher overall satisfaction, but this was observed only for happiness with sexual function. Although MtF transsexual patients often express concern about their ability to achieve orgasm after SRS, it appears that this may bear little relationship to postoperative regret or to self-rated improvement in quality of life following SRS.

It was hypothesized that later years of surgery, reflecting greater surgeon experience, would be associated with higher overall satisfaction, fewer reported complications, higher ratings of specific physical and functional outcomes of SRS, and more frequent ability to achieve orgasm after SRS. In most instances, however, significant associations were not found. Later years of surgery were significantly associated with greater overall happiness with SRS result but not with other general measures of satisfaction. Later years of surgery were significantly associated with fewer instances of vaginal stenosis during sexual arousal and with greater satisfaction with vaginal depth and width, but not with fewer complications of other kinds or with superior outcomes in other physical or functional categories.

Year of surgery was significantly but negatively associated with ability to achieve orgasm with masturbation after SRS, which might seem counterintuitive. Although this finding could reflect minor variations in surgical technique over time (e.g., more complete removal of sexually sensitive periurethral erectile tissue), it might also reflect patients' increasing familiarity over time with their surgically modified genitals, resulting in the ability to more reliably achieve orgasm through self-stimulation.

Limitations, generalizability, and suggestions for further research

Only 32% of eligible persons returned valid questionnaires, raising the possibility that these participants may not have constituted a representative sample of Meltzer's MtF SRS patients during the 6-year study period. An earlier report (Lawrence, 2003) addressed this issue by comparing participants who underwent SRS in partial year 2000, for whom the response rate was 79%, with participants who underwent SRS from partial year 1994 through 1999, for whom the overall response rate was only 29%, on 24 demographic, personality, treatment, and outcome measures. No significant differences between these groups of participants were found for any of the measures examined (for details, see Lawrence, 2003, p. 310). Because participants from partial year 2000 comprised 79% of the group of patients who underwent SRS in that partial year, they probably constituted a fairly representative sample of that patient group. The most parsimonious explanation of the many observed similarities between these participants and participants from earlier years is that both groups probably constituted fairly representative samples of a postsurgical population that remained reasonably consistent with regard to many demographic,

personality, treatment, and outcome characteristics over the 6-year study period. Assuming that this explanation is correct, biases related to the survey's low response rate were probably small. Because the cost of SRS with Meltzer was higher than with many other surgeons who perform MtF SRS, participants may not have constituted a representative sample of post-SRS MtF transsexuals in the United States.

Although the survey questionnaire described the complications of SRS in both lay and professional terms, complications reported by patients may not correspond exactly to what surgically trained persons would regard as complications. Consequently, comparison of the prevalence of self-reported complications in this study with the prevalence of complications in studies in which assessments were conducted by surgically trained personnel (e.g., those in Table 1) should be undertaken cautiously, if at all.

One of the unexpected findings of this study was the prevalence of genital pain complaints following SRS. Experienced by 9% of participants, genital pain was the second-most-common complication reported and was the only complication significantly associated with less improvement in quality of life after SRS. Although some reports of genital pain may have occurred primarily in the context of vaginal penetration, this appears not to have been true in at least a substantial minority of cases. Pain with vaginal penetration is a recognized phenomenon following MtF SRS (Blanchard et al., 1987; Krege, Bex, Lümmen, & Rübben, 2001; Stein, Tiefer, & Melman, 1990; van Noort & Nicolai, 1993), but other types of genital pain have rarely been described or discussed. Further study of the prevalence, nature, and consequences of post-SRS genital pain might better inform prospective patients and their caregivers about this potential complication and might contribute to reducing its prevalence.

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